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Installation of a Simple Float-Based Flood Early Detection Device as a Community Early Warning System in Sidaharja Village

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ABSTRACT

Sidaharja Village, Suradadi District, Tegal Regency, is one of the areas with potential flood risk due to river overflow, particularly around the village connecting bridge where the ground level is relatively close to the river surface. The main problem faced by the community is not only flood risk, but also the absence of a simple early warning system that is easy to understand, easy to install, and practical for residents to use. This community service program aimed to provide education on flood hazards while installing a simple flood early detection device as an initial warning medium for nearby residents. The implementation method consisted of site surveys, community clean-up activities around the bridge, device design and assembly, functional testing, device installation, demonstration of how the device works, and handover of the device to village officials and youth organization members. The device was developed using a float mechanism and a simple electrical circuit. When the water level reaches a certain threshold, the float activates the otolevel switch, which turns on a warning light and siren. The results of simple interviews with 15 residents showed that 10 residents were categorized as understanding and 5 residents were categorized as moderately understanding the function and mechanism of the device after the socialization and demonstration activities. These findings indicate an initial improvement in residents' understanding of flood early warning, although the evaluation remains descriptive and does not yet measure long-term preparedness impacts. The program produced outputs in the form of a simple flood early detection device, educational media, and initial community experience in understanding an early warning system based on simple technology. Program follow-up is needed through device performance monitoring, periodic maintenance, more measurable activation threshold determination, and strengthening residents' roles in maintaining the sustainability of the device.

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Introduction

Flooding is one of the hydrometeorological disasters that frequently causes material losses, disruption of community activities, infrastructure damage, and risks to residents' safety. In the Indonesian context, flood risk remains an important concern because many residential areas are located around rivers, lowlands, coastal zones, and areas with limited drainage systems. Through the Indonesian Disaster Risk Index, the National Disaster Management Agency shows that disaster risk assessment needs to be examined down to the regional level so that risk reduction efforts can be more aligned with the characteristics of each area (Badan Nasional Penanggulangan Bencana [BNPB], 2024). At the global level, early warning systems are also an important part of disaster risk reduction strategies because earlier warnings can provide communities with time to prepare, secure belongings, avoid dangerous locations, and take rescue actions (United Nations Office for Disaster Risk Reduction [UNDRR] & World Meteorological Organization [WMO], 2022). Thus, the issue of flooding is not only related to the occurrence of overflowing water, but also to community readiness to receive danger signals quickly and in a way that is easy to understand.

Sidaharja Village, Suradadi District, Tegal Regency, is one of the areas with potential flood risk due to the presence of a river and connecting bridges that are vulnerable to overflow during the rainy season. The village has 2,585 households or 9,048 residents, with community livelihoods including fisheries, small businesses, agriculture, and other occupations. The village is also located along the Pantura route and has several bridges connecting one village to another. One bridge of particular concern is located on the border between Sidaharja Village and Plumbungan Village because the ground surface and river level are relatively close. This condition makes the bridge area a potential initial point of impact when river discharge increases. Therefore, the community needs not only education about flood hazards, but also a simple early warning device that can provide visual and sound alerts when the water reaches a certain level.

The main problem faced by the Sidaharja Village community is the absence of a simple, affordable, easy-to-understand flood early warning system that can be installed at vulnerable points. Until now, residents' awareness of flood risk has largely depended on direct observation of river conditions. This method has limitations because residents are not always present at the bridge location, especially at night or during heavy rain.

In addition, the environmental condition around the bridge still requires attention, particularly in relation to cleanliness and the presence of waste that can worsen water flow. An early warning system installed directly at a vulnerable point is needed so that residents can receive faster warning signals through lights and a siren. In an early warning system, success is determined not only by the ability to detect changes in environmental conditions, but also by the system's ability to deliver warnings that can be received, understood, and acted upon by the community (UNDRR & WMO, 2022).

Recent studies show that flood early warning systems can be developed through various approaches, ranging from ultrasonic sensor-based systems, microcontrollers, and the Internet of Things to digital notification applications. Faturochman et al. (2023) designed a flood early warning system using an ultrasonic sensor, microcontroller, website, and Telegram Chat Bot to monitor water levels and provide notifications. Dewi et al. (2023) also developed a flood detection device based on Arduino Uno and ultrasonic sensors so that communities could receive warnings before water levels rose further. In addition, Rizal et al. (2024) showed that flood early detection can be carried out by integrating several sensors, such as water flow sensors, rainfall sensors, and ultrasonic sensors, to monitor flood potential. Although these technologies continue to develop, implementation at the village level still needs to consider cost, ease of maintenance, component availability, residents' ability to understand the device, and suitability to local conditions.

Based on these conditions, this community service program offered a solution in the form of installing a simple flood early detection device at the bridge between Sidaharja Village and Plumbungan Village. The device was designed using relatively accessible components, such as a float or otolevel switch, warning light, siren, panel, battery, and simple electrical circuit. Its working principle uses changes in water level that lift the float and activate the warning circuit. When the water reaches the predetermined threshold, the light and siren turn on as warning signals for nearby residents. The choice of a simple device was based on the consideration that village communities need technology that not only functions technically, but is also easy to read, remove, maintain, and replicate at other vulnerable points. Santosa et al. (2021) show that training in the application of flood detection devices can become part of community empowerment because residents not only receive the device, but also understand its working mechanism and benefits for preparedness.

The research gap in this activity lies in the need to provide a very simple flood early warning system based on local components and installed directly at a vulnerable village point. Some studies and developments of flood detection devices have used digital sensors and internet-based notification systems. However, not all village locations have sufficient resources, internet networks, technical capacity, and maintenance costs to operate more complex systems. Therefore, this program selected a simple float-based device using lights and a siren as an appropriate technology approach. The practical novelty of this activity lies in the integration of flood-prone point surveys, community clean-up around the bridge, portable device assembly, device installation, demonstration of how the device works, and resident education regarding the causes and hazards of flooding. Thus, this activity did not only focus on the device as a product, but also on improving residents' initial understanding and preparedness.

The aim of this community service program was to install and demonstrate a simple flood early detection device as an initial warning system for the Sidaharja Village community, while also providing education about the causes, impacts, and mitigation of flooding. Specifically, the activity was directed toward: (1) providing residents with initial understanding of the importance of a flood early warning system; (2) introducing the working principle of a float-, light-, and siren-based device; (3) installing the device at a bridge location vulnerable to river overflow; and (4) encouraging residents and youth organization members to maintain and monitor the device periodically. This program is expected to become an initial step in building community preparedness based on simple technology. However, it must be emphasized from the outset that this activity represents an initiation stage of an early warning system, so the long-term effectiveness of the device still requires field performance testing, periodic monitoring, and further mentoring.

Method

This community service activity was conducted in Sidaharja Village, Suradadi District, Tegal Regency, Central Java Province. The activity was implemented on August 28, 2021, involving approximately 20 participants consisting of Sidaharja Village officials, members of Karang Taruna Sidaharja, and students of Universitas Pancasakti Tegal. The main activity location was the bridge area on the border between Sidaharja Village and Plumbungan Village, which was selected because it is one of the vulnerable points when river discharge increases during the rainy season. The location was selected based on an initial survey of river conditions, bridge position, resident access, and the community's need for a simple and easy-to-understand flood early warning system.

The implementation method used a participatory-educational approach through community clean-up activities, device installation, demonstration of how the device works, resident education, and handover of the device to village representatives. This approach was selected because an early warning system requires not only a device, but also residents' understanding of the device's function, working mechanism, danger signals, and maintenance. UNDRR and WMO (2022) emphasize that an effective early warning system must be able to connect hazard monitoring, warning communication, and community capacity to understand and respond to warnings. Therefore, this activity did not only focus on assembling simple technology, but also on education and resident involvement so that the device could be understood and used practically.

The first stage was the initial survey and needs identification. The team conducted direct observations of the river and bridge where the device would be installed. The survey was conducted to identify possible installation points, water flow direction, potential water level rise, the safety of the device position, and residents' access to see or hear the warning. At this stage, the team also observed the environmental condition around the bridge, including the presence of waste and potential barriers to water flow. The survey results became the basis for determining the model of the device to be used, namely a simple flood early detection device based on a float or otolevel switch, warning light, and siren. This simple model was selected based on residents' need for a device that is easy to install, easy to read, and easy to maintain.

The second stage was component preparation and device design. The team prepared several main components, namely an MCB Matsuka C6 230/400 V-50 Hz, mini motor siren AC 220 V, otolevel PS-70AB 110/220 V 50/60 Hz, red blinking rotary signal lamp N-1101 12-220 V, TAV panel cabinet 20 × 30 × 12, 10-ampere battery, DC-AC inverter, cables, and a portable frame. These components were assembled to form a simple warning system that operates based on water level rise. The working principle of the device combines a float or otolevel mechanism with a closed electrical circuit. When the water rises and lifts the float to a certain threshold, the otolevel switch activates and the electrical current turns on the light and siren as warning signals. This type of simple device is relevant for community service activities because it uses components that are relatively easy to find and can be understood by nontechnical community members (Santosa et al., 2021).

The third stage was assembly and initial functional testing. Assembly was carried out by placing the electrical components inside the panel cabinet to better protect them from external disturbances. The circuit was then connected to a battery and inverter as the power source, while the float or otolevel switch was positioned as the trigger for system activation. After the device was assembled, the team conducted an initial simulated functional test by raising the float position or placing the device in a test container filled gradually with water. The indicators of successful functional testing included: (1) the float moved according to the rising water level; (2) the otolevel switch activated when the float reached the predetermined threshold; (3) the warning light turned on; (4) the siren sounded; and (5) the system returned to inactive when the water level or float position decreased. This simulated test was important to ensure that the device functioned before it was installed at the bridge location. When technical data are available, the activation threshold of the device can be recorded in terms of water level height or float position when the light and siren begin to activate.

The fourth stage was community clean-up and preparation of the installation site. The clean-up activity was conducted around the bridge environment to clear the installation area and increase residents' concern for the condition of the river surroundings. This stage was important because flood problems are not only related to rising water levels, but also to environmental conditions, waste, and flow barriers. Through community clean-up, residents were involved from the beginning so that the activity was not only technical, but also educational and participatory. In addition, residents' involvement in preparing the site helped increase their sense of ownership of the device to be installed.

The fifth stage was device installation on the bridge. After placement permission was obtained, the device was installed at the point determined based on the survey results. The position of the device was adjusted so that the float could respond to rising water levels, while the warning light and siren could be seen and heard by nearby residents. At this stage, the team also explained again the working sequence of the device, starting from rising water, float movement, otolevel activation, and the turning on and sounding of the warning signals. The device was installed in a portable manner so that it would be easier to remove, move, or maintain if damage occurred. The portable approach was selected because devices placed in open spaces may face weather disturbances, damage risks, and the need for periodic maintenance.

The sixth stage was demonstration and education for residents. The demonstration was conducted to show how the device works when the water rises to a certain threshold. Residents were given explanations about the function of each component, the float-based working principle, the meaning of the light and siren, and the initial actions that need to be taken when the device activates. In addition to the direct demonstration, the team also developed a video and poster explaining how the device works and providing education about the causes and hazards of flooding. These media were published through the KKN Sidaharja social media account so that residents could access them again. Faturochman et al. (2023) show that flood early warning systems can be developed through water level monitoring and the delivery of warning information to users. In this activity, the same principle was applied in a simpler form through lights and a siren so that it could be easily understood by residents.

The seventh stage was device handover. After installation and demonstration were completed, the device was handed over to village officials and Karang Taruna Sidaharja as parties expected to assist in monitoring and maintaining the device. This handover aimed to ensure that the device was not only an activity output, but also had local responsibility. At this stage, the team provided explanations about simple maintenance, such as checking the battery, cables, float position, panel, light, siren, and physical condition of the frame. The local person in charge also needs to pay attention to potential disturbances, such as weather-related damage, vandalism risks, dirt or waste that obstructs float movement, and the need for periodic checks before and during the rainy season.

The activity evaluation was conducted descriptively through implementation observation, activity documentation, functional testing of the device, and simple interviews with residents. The evaluation focused on two aspects: technical evaluation of the device and evaluation of residents' understanding. Technical evaluation was carried out by observing whether the device turned on when the float reached the activation threshold, whether the siren and light functioned, whether the electrical circuit operated normally, and whether the device position allowed residents to receive warning signals. Evaluation of residents' understanding was conducted after the socialization and device demonstration through brief interviews with 15 residents who participated in the activity. The interviews were conducted after the demonstration so that residents could respond based on the explanations and their experience of seeing how the device worked.

The interview questions were prepared based on indicators of residents' understanding of the device function and initial preparedness. The indicators used included: (1) understanding of the causes of flooding around the bridge; (2) understanding of the function of the flood early detection device; (3) understanding of how the float or otolevel switch, light, and siren work; (4) understanding of initial actions when the device activates; and (5) understanding of the need for device maintenance. The category "understanding" was given to residents who were able to explain the function of the device, mention the warning signals that appeared, and mention initial actions when the siren or light activated. The category "moderately understanding" was given to residents who were able to explain part of the device function, but still needed further explanation regarding technical aspects or follow-up actions. The category "less understanding" was used when residents were not yet able to explain the basic function of the device, while "not understanding" was used when residents could not explain either the function or warning signals of the device. This indicator-based evaluation model is important so that the results of the activity are not stated generally, but have a clearer basis for assessment (Kidder et al., 2024).

Evaluation data were analyzed descriptively. Technical data on the device were presented in the form of descriptions of functional test implementation, installation conditions, and device performance indicators. Residents' interview data were presented in the form of numbers and percentages for each understanding category, namely understanding, moderately understanding, less understanding, and not understanding. The analysis was not intended to prove the overall effectiveness of the device or its impact on long-term preparedness, but to describe the initial achievement of the program, the basic function of the device, and indications of residents' understanding after socialization and demonstration. Therefore, the evaluation results should be understood as an initial evaluation based on a community service activity, while field performance testing under actual flood conditions still requires further monitoring.

Results

Community Participation and Activity Implementation

The community service activity was implemented through a clean-up activity around the bridge environment, installation of a simple flood early detection device, demonstration of how the device works, education on the causes and hazards of flooding, and handover of the device to village officials and Karang Taruna Sidaharja. During the activity, participants showed active involvement, particularly in cleaning the bridge area, observing the device installation process, and participating in the explanation session on how the device works. Community involvement became an important aspect because a flood early detection device does not only require technical installation, but also requires community understanding of its function, warning signals, and maintenance needs.

This activity produced several main outputs, namely the installation of a simple flood early detection device in the bridge area vulnerable to river overflow, the implementation of a demonstration on how the device works, the availability of educational media in the form of videos and posters, and the handover of the device to village officials and the youth organization. Thus, the program was not merely a socialization activity, but also produced an early warning device that could be directly seen and understood by the community.

Results of Resident Understanding Interviews

The evaluation of resident understanding was conducted through simple interviews after the socialization and device demonstration. Of the 15 residents interviewed, 10 people, or 67%, were categorized as understanding, while 5 people, or 33%, were categorized as moderately understanding. No residents were categorized as less understanding or not understanding. The "understanding" category indicates that residents were able to explain the function of the device, recognize the warning signals in the form of lights and a siren, and understand that the device works when the water reaches a certain threshold. The "moderately understanding" category indicates that residents understood the basic function of the device, but still required additional explanation regarding technical operation, maintenance, or follow-up actions when the device is activated.

These results indicate an initial improvement in residents' understanding after the socialization and demonstration of the device. However, this finding needs to be interpreted cautiously because the evaluation was conducted through simple interviews with a limited number of respondents. Therefore, the interview results cannot yet be concluded as evidence of long-term preparedness improvement, but rather as an initial indication that residents understood the basic function of the device and the importance of a flood early warning system.

Technical Process of Device Construction and Installation

The initial stage of the activity was carried out through the purchase of components and a site survey. The components prepared included an MCB Matsuka C6, mini motor siren AC 220 V, otolevel PS-70AB, blinking rotary signal lamp, panel cabinet, 10-ampere battery, DC-AC inverter, cables, and a portable frame. The site survey was conducted to examine river conditions, bridge position, possible device installation points, and areas that could be easily seen and heard by residents when the device is activated.

After the site survey, the team designed and assembled the simple flood early detection device. The device works based on the principle of a float mechanism and an electrical circuit. When the water rises, the float is lifted. At a certain position, the float activates the otolevel switch so that the electrical circuit turns on the warning light and siren. This working principle utilizes changes in the float position caused by rising water, enabling the device to provide visual and audible warning signals. The electrical installation diagram in the manuscript shows the connection among the otolevel switch, siren, lamp, and MCB, while the assembly documentation shows the process of installing the components into the device panel.

Functional Testing and Field Installation

Before being installed on the bridge, the device was tested in a simple manner to ensure that its main components could function. The functional test was conducted by raising the float position or simulating water level rise until the float reached the activation threshold. The indicators of successful functional testing included the float moving upward, the otolevel switch activating, the warning light turning on, and the siren sounding. Based on the initial test results, the device responded when the float reached the preset threshold position.

After the functional test, the device was installed in the bridge area identified as vulnerable to river overflow. The installation was carried out in a portable manner so that the device could be removed, relocated, and rechecked if necessary. During installation, residents were given explanations about how the device works, the meaning of the light and siren, and the need to check the condition of the device periodically. However, testing in this activity was still limited to initial functional testing and did not include testing under actual flood conditions. The activation threshold had also not been quantitatively documented in water height units, so future activities need to conduct more standardized measurements, for example by recording the water level when the float begins to activate the light and siren.

Table 1. Components of the Simple Flood Early Detection Device and Their Functions

Component	Function	Working Indication
Otolevel/float	Detects rising water levels	Activates when the float rises to a certain threshold
Mini motor siren AC 220 V	Provides an audible warning	The siren sounds when the circuit is activated
Blinking rotary signal lamp	Provides a visual warning	The lamp turns on or rotates when the circuit is activated
MCB Matsuka C6	Protects the electrical circuit	Cuts off the current when a disturbance occurs
Panel cabinet	Protects electrical components	Components are arranged inside the panel
10-ampere battery	Electrical power source	Provides power for the system
DC-AC inverter	Converts DC current into AC current	Adjusts battery power to match AC components
Portable frame	Supports and facilitates device installation	The device can be installed, removed, or relocated

Table 2. Achievement of Program Outputs and Initial Outcomes

Activity Aspect	Output Produced	Initial Outcome Observed	Limitation Note
Community clean-up around the bridge	The area around the bridge was cleaned	Residents were involved in environmental preparedness activities	No long-term cleanliness monitoring was conducted
Device construction	A simple flood early detection device was successfully assembled	Residents directly observed the form and components of the device	Device durability under weather conditions needs longer testing
Device functional testing	The light and siren could be activated when the float rose	The device demonstrated its basic function as a visual and audible warning system	The activation threshold had not been recorded in water height units
Device installation	The device was installed in the bridge area vulnerable to flooding	Residents knew the device location and its basic working mechanism	Performance during actual flood conditions had not been documented
Socialization and demonstration	Device explanation, video, and educational poster were available	67% of residents understood and 33% moderately understood based on simple interviews	The number of respondents was still limited
Device handover	The device was handed over to village officials and the youth organization	A local party was expected to monitor the device	A maintenance schedule and technical person in charge are needed

In general, the results show that the program successfully produced a simple flood early detection device and provided an indication of improved resident understanding of the device function. Nevertheless, these results remain at the output and initial outcome levels. Evaluation of device performance under actual field conditions, device durability against weather, battery endurance, and the effectiveness of warnings in encouraging residents' actions still require further monitoring.

Discussion

Relevance of a Simple Device as a Community-Based Early Warning System

The results show that a simple flood early detection device can serve as a practical approach to introducing an early warning system to village communities. The device was designed using relatively accessible components, such as a float or otolevel switch, warning light, siren, battery, inverter, and panel. The strength of this approach lies in its simplicity, the readability of warning signals, and the ease with which residents can understand its working principle. In village contexts, simple appropriate technology is often more realistic than highly complex systems because it is easier to explain, install, and maintain by the local community.

This finding is relevant to the concept of community-based early warning systems. UNDRR and WMO (2022) emphasize that an effective early warning system does not only depend on hazard detection, but also on the ability to communicate warnings and encourage community action. In this activity, the light and siren functioned as direct and easily recognized forms of risk communication. However, to truly become an effective early warning system, this simple device needs to be followed by community response procedures, such as who checks the device, who informs other residents, and what actions should be taken when the siren is activated.

Indication of Resident Understanding and Evaluation Limitations

The interview results showed that 10 residents were categorized as understanding and 5 residents as moderately understanding. These data indicate that socialization and demonstration helped residents understand the basic function of the device. However, these results need to be interpreted proportionally. The number of respondents was only 15 residents, the evaluation method used simple interviews, and no systematic pre-post measurement was conducted. Therefore, the appropriate claim is not "a strong increase in community knowledge," but rather "an indication of improved resident understanding after the socialization and demonstration of the device."

In program evaluation, indicators need to be clearly formulated so that activity results can be interpreted more accurately. Kidder et al. (2024) explain that program evaluation helps implementers understand programs, build evidence, and improve decisions based on results. Based on this principle, the evaluation of this activity needs to be strengthened in future programs with more detailed instruments, such as question lists on device function, warning signals, initial evacuation actions, and device maintenance. Evaluation can also use simple pre-tests and post-tests so that changes in resident understanding can be measured more strongly.

Device Functional Testing and the Need for Field Testing

The added value of this article lies in its technical explanation of how the float-based device and electrical circuit work. The installation diagram, assembly photos, and device installation photos show that the program did not stop at socialization, but produced a real device. The initial functional test showed that the light and siren could be activated when the float reached a certain threshold. Thus, the device demonstrated its basic function as a visual and audible warning system.

However, the functional test still had limitations. First, the activation threshold had not been quantitatively recorded in water height units. Second, the test was preliminary and had not been conducted under varying actual water discharge conditions. Third, there were no records of battery endurance, siren sound range, light visibility at night or during heavy rain, and device stability under weather exposure. Faturochman et al. (2023) show that sensor-based flood warning systems can be designed to monitor water levels and send notifications more measurably. Although the device in this community service program was simpler, the testing principle still needs to be directed toward measuring water level, device response, and warning reliability. Therefore, follow-up activities need to record the device activation point, conduct gradual water level rise simulations, and monitor device performance during the rainy season.

Advantages of the Portable Approach and Accessible Components

The developed device has a portable design and uses components that are relatively easy to obtain. This advantage is important because devices installed in open areas need to be easy to remove, relocate, or repair. In village contexts, device sustainability is strongly influenced by ease of maintenance and the availability of spare parts. If the device is too complex or its components are difficult to obtain, the risk of the device not functioning after the program ends will be higher. Therefore, the use of simple components becomes a strength of the program because it opens the possibility of replication at other vulnerable points.

Santosa et al. (2021) show that training in the application of flood detection devices in the community can help residents understand the benefits of early warning technology. In line with this, the activity in Sidaharja shows that simple technology can be used as both an educational medium and an early warning device. However, the advantage of portability must also be balanced with security and maintenance systems. A device that is easy to remove can facilitate maintenance, but it also risks being moved without proper procedure, damaged, or lost if there is no local person in charge.

Challenges of Implementation and Device Sustainability

The application of a simple flood early detection device in the field has several challenges. First, the device is installed in an open space, making it vulnerable to rain, heat, humidity, rust, or physical damage. Second, electrical components such as cables, batteries, inverters, panels, lights, and sirens require periodic checking. Third, float movement can be obstructed by waste, mud, branches, or other objects carried by river flow. Fourth, there is a risk of vandalism or damage caused by human activity around the bridge. Fifth, the use of a battery as a power source requires maintenance, recharging, and replacement when its capacity decreases.

These challenges show that this simple device is not sufficient if it is only installed, but must be managed as part of a local preparedness system. Village officials and Karang Taruna can act as monitoring coordinators with a routine checking schedule, for example before the rainy season, after heavy rain, and after the siren activates. Residents also need simple procedures regarding the actions to be taken when the device turns on. Thus, program sustainability is not only determined by the existence of the device, but also by the presence of local mechanisms to maintain, test, and respond to warnings.

Program Implications and Replication Potential

This program has practical implications as an initial model of a flood early warning system based on simple technology. This model has the potential to be replicated in other villages with flood-prone river overflow points, especially in areas that do not yet have more advanced early warning systems. Replication can be carried out by adjusting the device design, installation position, power source, activation threshold, and community communication patterns. A simple float-, light-, and siren-based device can become an initial option for communities that need an affordable, easy-to-understand, and repairable warning system.

However, program replication must be accompanied by minimum testing standards. Several aspects need attention, including measurement of the water threshold, frame strength, panel protection against water, siren sound range, light visibility, and determination of a local person in charge. In addition, resident education needs to be expanded from merely understanding the device to understanding flood response procedures. In this way, the early detection device does not only become a technical output of community service, but also becomes part of a community preparedness system.

Program Limitations

This activity has several limitations. First, evaluation of resident understanding was only conducted through simple interviews with 15 people, so the results cannot represent the entire Sidaharja Village community. Second, the device functional test was still preliminary and had not included testing under actual flood conditions. Third, the device activation threshold had not been documented in water height units. Fourth, no long-term monitoring had been conducted regarding device durability, battery endurance, siren and light function, and resident responses when the device activates. Fifth, there were no written procedures for device maintenance and resident actions when the warning sounds. These limitations need to become the basis for developing future programs.

Conclusion

The community service activity in Sidaharja Village shows that the installation of a simple flood early detection device based on a float, light, and siren can become an initial step in introducing an early warning system to the community. This program produced several main outputs, namely a simple flood early detection device, a demonstration of how the device works, educational media in the form of videos and posters, and device handover to village officials and Karang Taruna. Simple interviews with 15 residents showed that 10 residents, or 67%, were categorized as understanding and 5 residents, or 33%, were categorized as moderately understanding after the socialization and device demonstration.

These results indicate an initial improvement in residents' understanding of the device function and the importance of flood early warning. However, this achievement still needs to be understood as an initial result because the evaluation was conducted descriptively with a limited number of respondents. In addition, the device functional test showed that the light and siren could be activated when the float reached a certain threshold, but the activation threshold had not been recorded quantitatively and the device performance under actual flood conditions had not been documented.

Thus, this program is appropriately positioned as an initiation stage of a flood early warning system based on simple technology. The strength of the program lies in the use of accessible components, a portable design, and warning signals that are easy for residents to understand. However, this device still has limitations, especially related to long-term durability, battery and electrical component maintenance, the risk of waste or mud obstructing the float, and the need for periodic checks. Therefore, program follow-up needs to be directed toward monitoring device performance, recording activation thresholds, preparing a maintenance schedule, involving village officials and Karang Taruna as local persons in charge, and strengthening residents' response procedures when the device is activated.

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Research Ethics Statement

This community service program was conducted in accordance with the ethical principles of community-based academic activities, including respect for participants, voluntary participation, transparency, accountability, safety, and research integrity. Since the program focused on flood hazard education, community clean-up, installation of a simple flood early detection device, device demonstration, activity documentation, functional testing, and simple interviews on residents' understanding, it did not involve clinical intervention, biomedical procedures, biological specimens, or the collection of sensitive personal health data. Participants and community partners were informed about the purpose, procedures, and expected outputs of the activities before implementation. Participation in the clean-up activity, demonstration, education session, and interview was voluntary. The data used in this article were limited to program records, observation notes, functional test documentation, interview summaries, activity photographs, educational media, and handover records. All information was used responsibly while maintaining respect for participant confidentiality, community safety, and the local context.

Author Contributions
Mohammad Arkham Zulqirom Putra: conceptualization, coordination of the community service program, development of the simple flood early detection intervention design, supervision of device installation, analysis of program outputs and initial outcomes, and writing of the original draft.
Inayatun Illahiyah: preparation of flood hazard education materials, support for community coordination, assistance in resident socialization, and contribution to manuscript review.
Shela Arum Viana: field observation, support for site survey activities, documentation of bridge conditions, and assistance in identifying community needs related to flood early warning.
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Citra Melyasari: preparation of activity documentation, recording of program outputs, organization of photographs and field notes, and assistance in compiling program achievement tables.
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Conflict of Interest
The authors declare that there is no conflict of interest regarding the implementation, authorship, or publication of this article.

Artificial Intelligence Use Statement
The authors declare that artificial intelligence was used only as a limited technical support tool for language editing, sentence refinement, grammar checking, translation assistance, and improving manuscript readability. All processes involving program planning, partner coordination, site survey, device assembly, functional testing, device installation, community education, data collection, descriptive evaluation, academic interpretation, and conclusion development remain the full responsibility of the authors.

Data Availability Statement
The data supporting the findings of this article consist of community service program documents, activity reports, field observation notes, site survey records, device component documentation, functional testing notes, activity photographs, educational media, simple interview summaries, handover records, and descriptive evaluation notes related to the installation of a simple float-

based flood early detection device in Sidaharja Village. Due to participant confidentiality, community safety considerations, and ethical considerations in community-based activities, complete raw documentation is not publicly available. Additional information regarding the program implementation and evaluation procedures may be obtained from the corresponding author upon reasonable request.

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